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REMARKS

Claim Rejections - 35 U.S.C. § 102

Claims 1-5 and 11-13 have been rejected under 35 U.S.C. § 102(b) over European Patent Application Publication No. 0 605 103 A1 to Takahashi. Claim 1 has been amended to more clearly recite the invention. In so doing, the distinctions between the claimed invention and the teachings of Takahashi have been highlighted. Claim 2 has been canceled for consistency with the amendment to claim 1. Claims 3-5 and 11-13 depend from claim 1.

In an immersion lithography system, the exposure pattern that exits a final element of a lithographic imaging system and becomes incident on a wafer travels through a specific portion of the immersion medium. The Applicant has referred to this volumetric portion of the immersion medium as the "traversal volume" (see, for example, page 4, lines 14-23).

An inventive feature of the claimed subject matter is that the index of refraction of the traversal volume is detected and, from that information, a determination is made as to whether conditions are favorable to exposing the wafer (see, for example, page 4, line 27 to page 5, line 5 and page 8, line 32 to page 9, line 7). The determination can be based on index of refraction uniformity across the traversal volume as a localized change in index of refraction can adversely effect the quality of the exposure. The determination can be further based on whether a measured index of refraction is within an acceptable range.

Takahashi does not teach or reasonably suggest the claimed invention. Nor does Takahashi teach or reasonably suggest a system capable of carrying out the claimed invention. Takahashi teaches using a refractometer to measure the homogeneity of the liquid, but does not teach or suggest a way to measure index of refraction other than at a single location outside the traversal volume.

Traditionally, refractometers infer index of refraction by measuring the critical angle of light at the interface of two mediums, one of which is the material to be

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measured. As a result, the index of refraction is only measured in a localized position at the interface of the two materials.

The apparatus of Takahashi cannot measure the claimed characteristics of the traversal volume of the immersion medium without making unmotivated changes to the teaching of Takahashi. Takahashi shows the refractometer 803 well outside the traversal volume (figure 8). This is for good reason. To measure the index of refraction in the traversal volume, the refractometer of Takahashi would have to be placed in the traversal volume. However, this would ruin the exposure. It is conceivable that the index of refraction could be measured in the traversal volume and then the refractometer could be moved. However, by the time the refractometer is moved out of the way, the index of refraction could have changed, possibly due to the movement of the refractometer.

The Examiner has cited column 11, lines 54-57 for the proposition that "the refractive index is measured during different times at different locations on the immersion fluid." The exact reading of this passage is: "the state of flow motion may be measured by using the refractometer 803 and the sequence may be continued after the liquid motion stops." It is respectfully submitted that the "state of flow motion" is not the same of refractive index. For example, flow motion more likely refers to fluid dynamic principles such as pressure, rate and/or turbidity. Also, there is no indication that multiple locations are monitored for the state of flow motion. It is more likely that the flow is monitored as the medium passes by the refractometer.

For at least these reasons, claim 1 recites patentable subject matter. The dependent claims recite additional features that are novel and unobvious.

For example, claim 3 recites that the determination of uniformity is from a first location in the traversal volume to a second location in the traversal volume. At best, Takahashi measures index of refraction at one location outside the traversal volume.

Claim 4 recites that the determining includes correlating a measured index of refraction at a measurement wavelength to an exposure index of refraction at a

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wavelength of the exposure pattern. Takahashi does not teach or suggest making this correlation.

Claim 5 recites that the index of refraction is measured throughout the traversal volume. At best, Takahashi measures index of refraction at one location outside the traversal volume.

Since claim 1 and the claims depending therefrom recite patentable subject matter, reconsideration and withdrawal of the rejection under 35 U.S.C. § 102(b) is respectfully requested.

Claim Rejections - 35 U.S.C. § 103

Claims 6-10 and 18-20

Claims 6-10 and 18-20 have been rejected under 35 U.S.C. § 103(a) over Takahashi in view of U.S. Patent No. 5,151,752 to Oono. Claim 9 has been canceled for consistency with the amendment of claim 1. Claims 6-8 and 10 depend from claim 1. Independent claim 18 has been amended to more clearly recite the invention. In so doing, the distinctions between the claimed invention and the teachings of Takahashi have been highlighted. Claim 19 has been canceled for consistency with the amendment to claim 18. Claim 20 depends from claim 18.

Although Oono discloses measuring the index of refraction of a liquid using an interferometer, Oono does not cure the deficiencies of Takahashi with respect to at least claim 1. For example, Oono does not disclose determining if conditions are acceptable for lithographic wafer imaging in the claimed manner.

The deficiencies of Takahashi with respect to claim 1 apply equally with respect to claim 18 and, for sake of brevity, will not be repeated. But it follows that Oono does not cure the deficiencies of Takahashi with respect to claim 18. That is, Oono does not disclose determining if conditions are acceptable for lithographic wafer imaging in the claimed manner.

Furthermore, it is acknowledged that many inventions arise from a combination of old elements. But even if each individual claimed part can be identified in the prior

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art (which is not the case here), such identification is insufficient to defeat patentability of the whole claimed invention. To establish obviousness based on a combination of the elements disclosed in the prior art, there must be some motivation, suggestion or teaching of the desirability of making the specific combination that was made by the applicant.

The Examiner attempts to meet this burden by making the conclusion that it would have been obvious to use any type of refractometer. It is respectfully submitted that such a conclusion does not substitute for the showing required to render the specifically claimed combination obvious.

The Examiner contends that the Applicant "has not disclosed that the use of the interferometric refractometer solves a stated problem, has a specific benefit, or is for any particular purpose and it appears that the invention would perform equally well as a functional equivalent with the refractometer taught by Takahashi." The Applicant's view differs. Immersion lithography is a very delicate process. Minor imperfections in the traversal volume of the immersion medium can ruin the imaging of a wafer. Accordingly, the claimed invention is directed to making a determination of whether the traversal volume of the immersion medium is in a state for wafer exposure in a manner that minimizes the possibility of disturbing the traversal volume. This is an advancement in the art as disruptions to the traversal volume could lead to changes in index of refraction and/or other imaging issues. As explain above, Takahashi does not teach or suggest directly monitoring the index of refraction of the traversal volume portion of the immersion medium. As such, the claimed invention solves a particular problem (avoiding exposure when conditions are not acceptable), has a specific benefit over the prior art, and has a different performance than the system taught by Takahashi.

For at least these reasons, reconsideration and withdrawal of the rejection of claims 6-10 and 18-20 is respectfully requested.

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Claims 14-17

Claims 14-17 have been rejected under 35 U.S.C. § 103(a) over Takahashi in view of Oono and further in view of U.S. Patent No. 5,870,189 to Uesugi. Claims 14-17 depend from claim 1. Claim 15 has been amended to correct a typographical error. Uesugi does not cure the deficiencies of Takahashi and Oono with respect to claim 1. Therefore, claims 14-17 are patentable for at least the reasons discussed above.

Furthermore, these claims recite additional novel and unobvious features of the invention. For example, claim 16 recites that the laser beam used to detect index of refraction is also used to monitor for the presence of a foreign body. Such a combined use for a laser beam is not taught or suggested in the art.

For at least these reasons, reconsideration and withdrawal of the rejection of claims 14-17 is respectfully requested.

Conclusion

In light of the foregoing, it is respectfully submitted that the application is in condition for allowance and notice to that effect is requested. If it is determined that the application is not in condition for allowance, the Examiner is invited to initiate an interview with the undersigned representative to expedite prosecution of the application.

If there are any fees resulting from this communication, please charge same to our Deposit Account No. 18-0988, our Order No. H1530.

Respectfully submitted,

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